CoolMOS™ Power Transistor

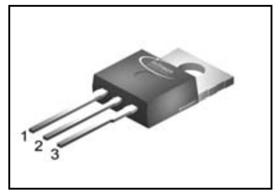
Features

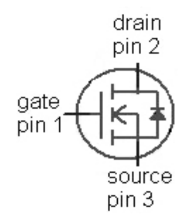
- New revolutionary high voltage technology
- Ultra low gate charge
- Periodic avalanche rated
- High peak current capability
- Ultra low effective capacitances
- Extreme d*v*/d*t* rated
- Improved transconductance

Product Summary

V_{DS} @ $T_{j,max}$	650	V
$R_{DS(on),max}$	0.75	Ω
I_D	6.2	A

PG-TO220-3-1





Type	Package	Ordering Code	Marking
SPP06N60C3	PG-TO220-3-1	Q67040-S4629	06N60C3

Maximum ratings, at T_j=25 °C, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	T_C=25 °C	6.2	A
		T_C=100 °C	3.9	
Pulsed drain current[1)]	$I_{D,pulse}$	T_C=25 °C	18.6	
Avalanche energy, single pulse	E_{AS}	I_D=3.1 A, V_{DD}=50 V	200	mJ
Avalanche energy, repetitive t_{AR}[1),2)]	E_{AR}	I_D=6.2 A, V_{DD}=50 V	0.5	
Avalanche current, repetitive t_{AR}[1)]	I_{AR}		6.2	A
Drain source voltage slope	d*v*/d*t*	I_D=6.2 A, V_{DS}=480 V, T_j=125 °C	50	V/ns
Gate source voltage	V_{GS}	static	±20	V
	V_{GS}	AC (*f*>1 Hz)	±30	
Power dissipation	P_{tot}	T_C=25 °C	74	W
Operating and storage temperature	T_j, T_{stg}		-55 ... 150	°C

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Thermal characteristics						
Thermal resistance, junction - case	R_{thJC}		-	-	1.7	K/W
Thermal resistance, junction - ambient	R_{thJA}	leaded	-	-	62	
	R_{thJA}	SMD version, device on PCB, minimal footprint	-	-	62	
		SMD version, device on PCB, 6 cm^2 cooling area[3)]	-	35	-	
Soldering temperature[4)]	T_{sold}	1.6 mm (0.063 in.) from case for 10 s	-	-	260	°C

Electrical characteristics, at T_j=25 °C, unless otherwise specified

Parameter	Symbol	Conditions	min.	typ.	max.	Unit
Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	V_{GS}=0 V, I_D=250 µA	600	-	-	V
Avalanche breakdown voltage	$V_{(BR)DS}$	V_{GS}=0 V, I_D=6.2 A	-	700	-	
Gate threshold voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=0.26 mA	2.1	3	3.9	
Zero gate voltage drain current	I_{DSS}	V_{DS}=600 V, V_{GS}=0 V, T_j=25 °C	-	0.1	1	µA
		V_{DS}=600 V, V_{GS}=0 V, T_j=150 °C	-	-	100	
Gate-source leakage current	I_{GSS}	V_{GS}=20 V, V_{DS}=0 V	-	-	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	V_{GS}=10 V, I_D=3.9 A, T_j=25 °C	-	0.68	0.75	Ω
		V_{GS}=10 V, I_D=3.9 A, T_j=150 °C	-	1.82	-	
Gate resistance	R_G	f=1 MHz, open drain	-	1	-	
Transconductance	g_{fs}	$\|V_{DS}\|>2\|I_D\|R_{DS(on)max}$, I_D=3.9 A	-	5.6	-	S

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Dynamic characteristics						
Input capacitance	C_{iss}	V_{GS}=0 V, V_{DS}=25 V, f=1 MHz	-	620	-	pF
Output capacitance	C_{oss}		-	200	-	
Reverse transfer capacitance	C_{rss}		-	17	-	
Effective output capacitance, energy related[5)]	$C_{o(er)}$	V_{GS}=0 V, V_{DS}=0 V to 480 V	-	28	-	
Effective output capacitance, time related[6)]	$C_{o(tr)}$		-	47	-	
Turn-on delay time	$t_{d(on)}$	V_{DD}=480 V, V_{GS}=10 V, I_D=6.2 A, R_G=12 Ω	-	7	-	ns
Rise time	t_r		-	12	-	
Turn-off delay time	$t_{d(off)}$		-	52	-	
Fall time	t_f		-	10	-	
Gate Charge Characteristics						
Gate to source charge	Q_{gs}	V_{DD}=480 V, I_D=6.2 A, V_{GS}=0 to 10 V	-	3.3	-	nC
Gate to drain charge	Q_{gd}		-	12	-	
Gate charge total	Q_g		-	24	31	
Gate plateau voltage	$V_{plateau}$		-	5.5	-	V

1) Pulse width limited by maximum temperature $T_{j,max}$ only

2) Repetitive avalanche causes additional power losses that can be calculated as $P_{AV}=E_{AR}*f$.

3) Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm^2 (one layer, 70 µm thick) copper area for drain connection. PCB is vertical in still air.

4) Soldering temperature for TO263: 220 °C, reflow

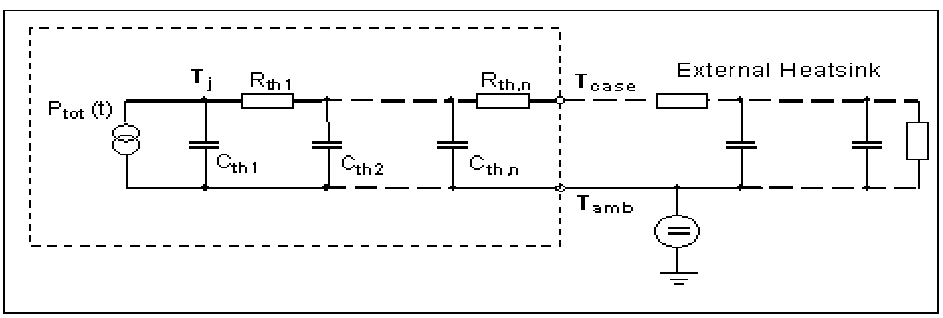
5) $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% $V_{DSS.}$

6) $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% $V_{DSS.}$

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Reverse Diode						
Diode continuous forward current	I_S	T_C=25 °C	-	-	6.2	A
Diode pulse current	$I_{S,pulse}$		-	-	18.6	
Diode forward voltage	V_{SD}	V_{GS}=0 V, I_F=6.2 A, T_j=25 °C	-	0.97	1.2	V
Reverse recovery time	t_{rr}	V_R=480 V, I_F=I_S, di_F/dt=100 A/µs	-	400	-	ns
Reverse recovery charge	Q_{rr}		-	3.5	-	µC
Peak reverse recovery current	I_{rrm}		-	25	-	A

Typical Transient Thermal Characteristics

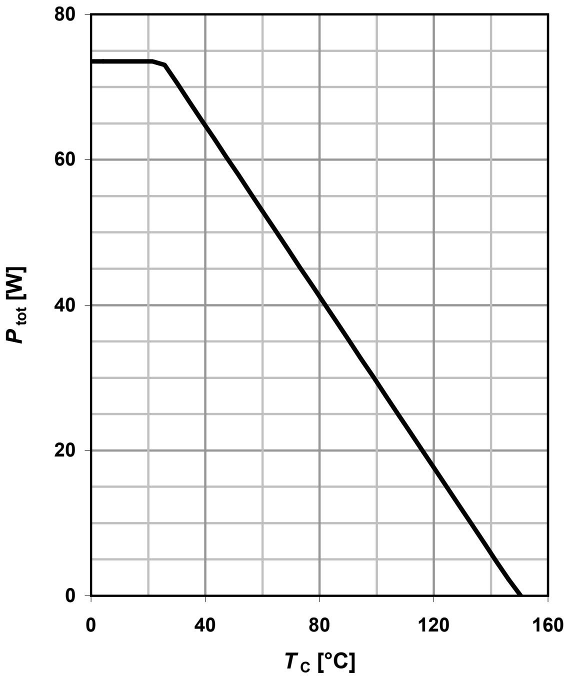
Symbol	Value	Unit	Symbol	Value	Unit
	typ.			typ.	
R_{th1}	0.0325	K/W	C_{th1}	0.0000502	Ws/K
R_{th2}	0.0448		C_{th2}	0.000303	
R_{th3}	0.251		C_{th3}	0.000428	
R_{th4}	0.31		C_{th4}	0.00243	
R_{th5}	0.301		C_{th5}	0.00526	
			C_{th6}	1.09[7)]	



[7)] C_{th6} models the additional heat capacitance of the package in case of non-ideal cooling. It is not needed if R_{thCA}=0 K/W.

1 Power dissipation

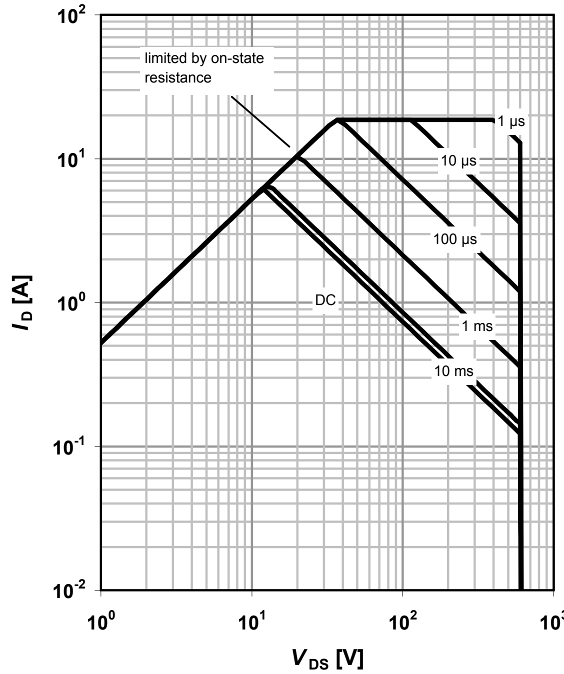
P_{tot}=f(T_C)



2 Safe operating area

I_D=f(V_{DS}); T_C=25 °C; D=0

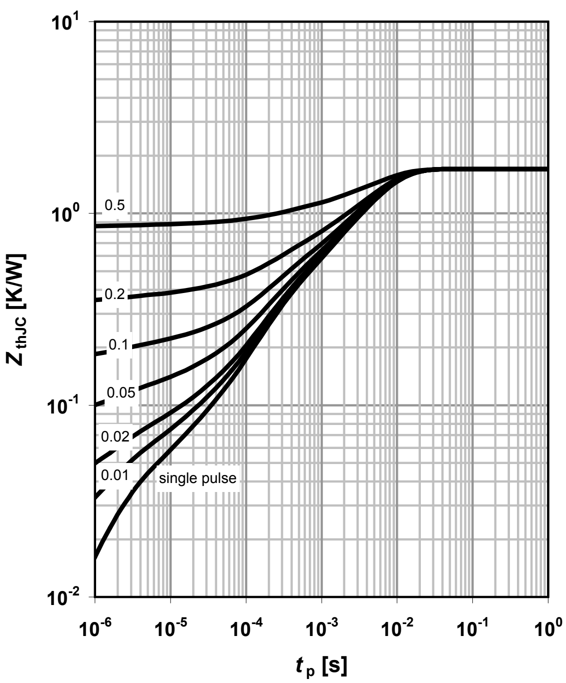
parameter: t_p



3 Max. transient thermal impedance

I_D=f(V_{DS}); T_j=25 °C

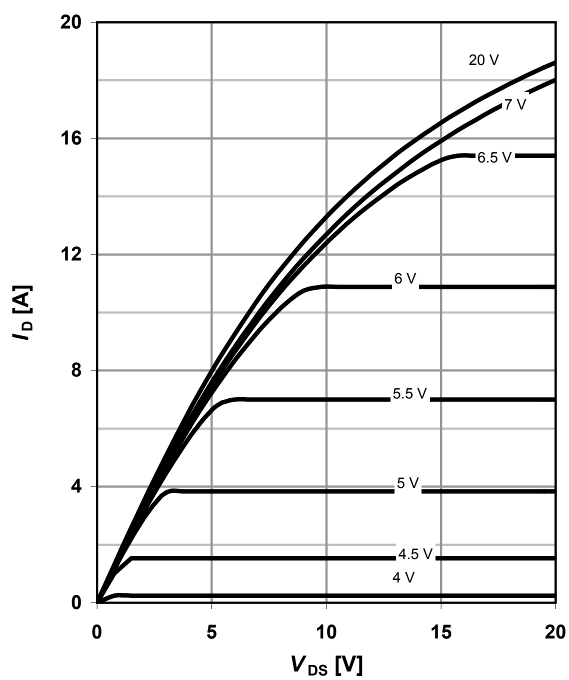
parameter: D=t_p/T



4 Typ. output characteristics

I_D=f(V_{DS}); T_j=25 °C

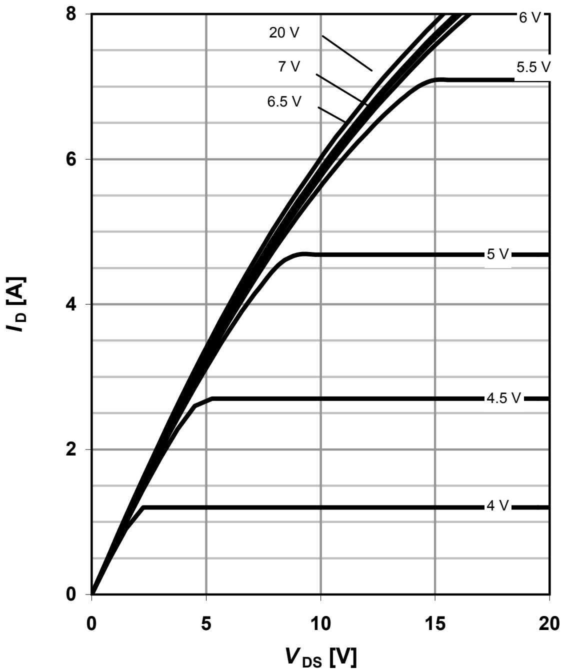
parameter: V_{GS}



5 Typ. output characteristics

$I_D=f(V_{DS})$; $T_j=150$ °C

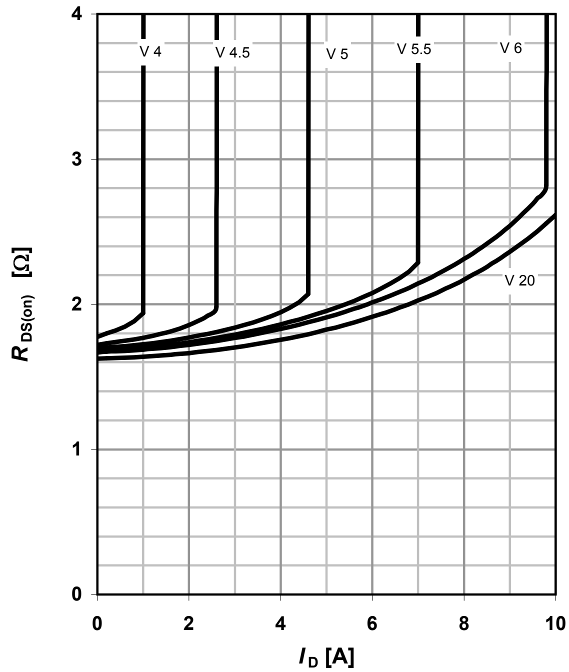
parameter: V_{GS}



6 Typ. drain-source on-state resistance

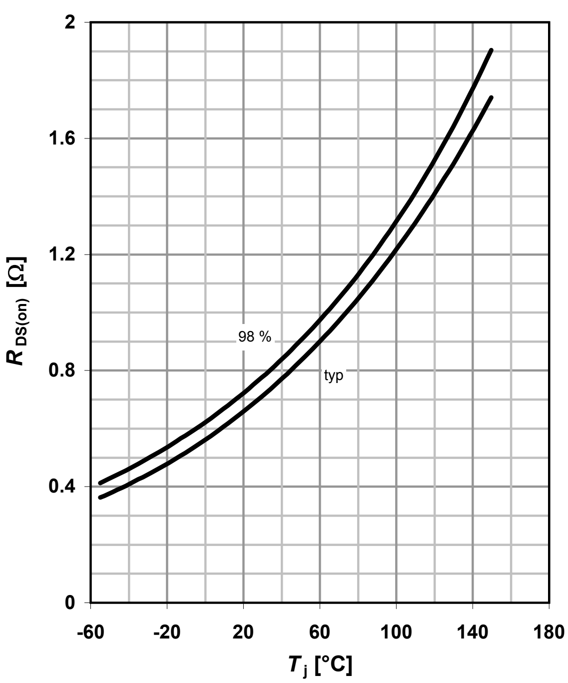
$R_{DS(on)}=f(I_D)$; $T_j=150$ °C

parameter: V_{GS}



7 Drain-source on-state resistance

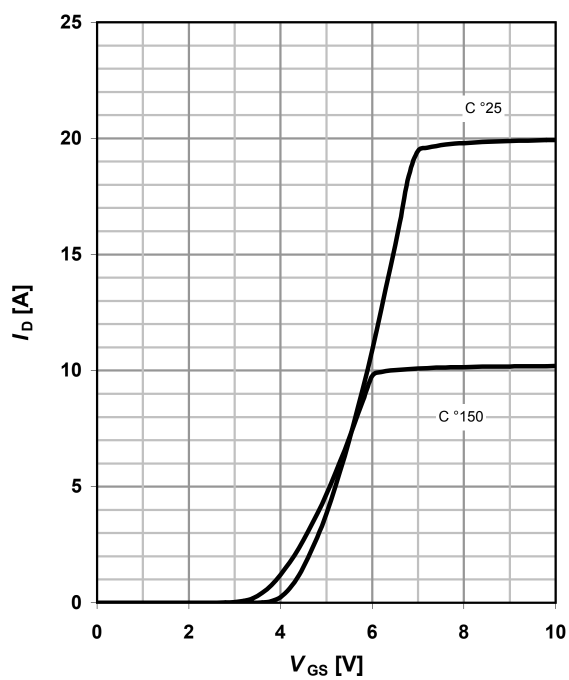
$R_{DS(on)}=f(T_j)$; $I_D=3.9$ A; $V_{GS}=10$ V



8 Typ. transfer characteristics

$I_D=f(V_{GS})$; $|V_{DS}|>2|I_D|R_{DS(on)max}$

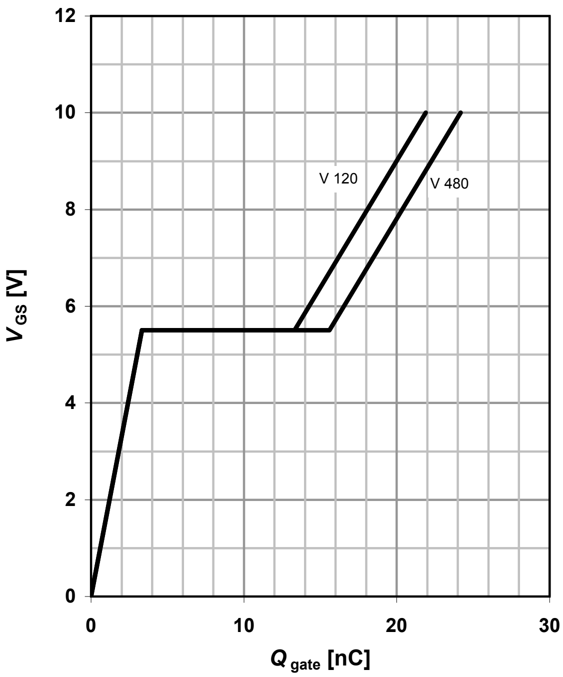
parameter: T_j



9 Typ. gate charge

V_{GS}=f(Q_{gate}); I_D=6.2 A pulsed

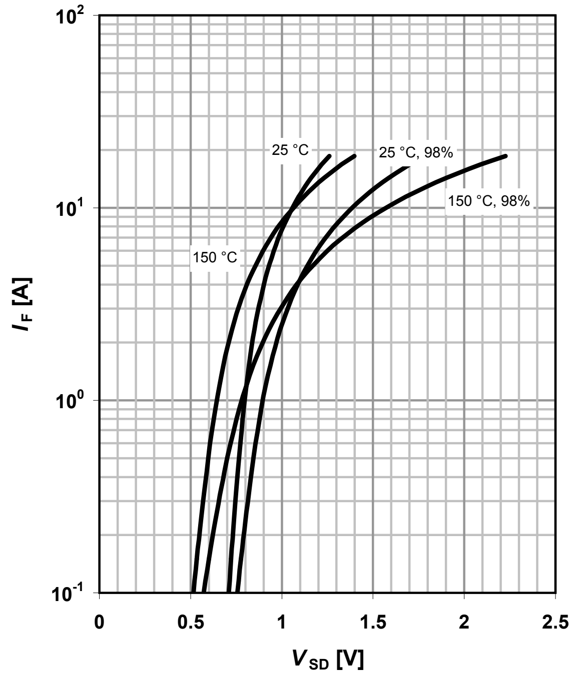
parameter: V_{DD}



10 Forward characteristics of reverse diode

I_F=f(V_{SD})

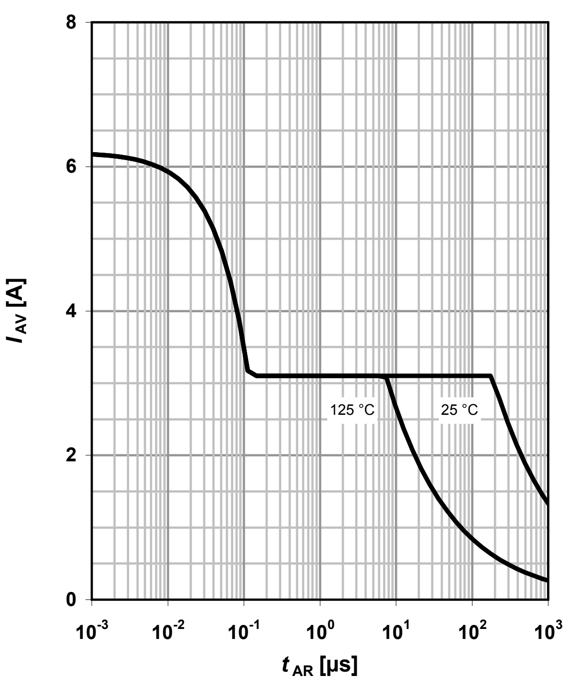
parameter: T_j



11 Avalanche SOA

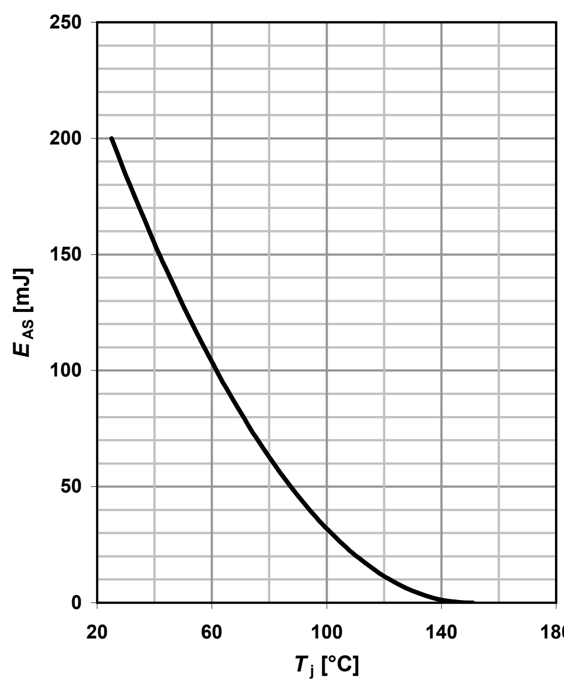
I_{AR}=f(t_{AR})

parameter: $T_{j(start)}$



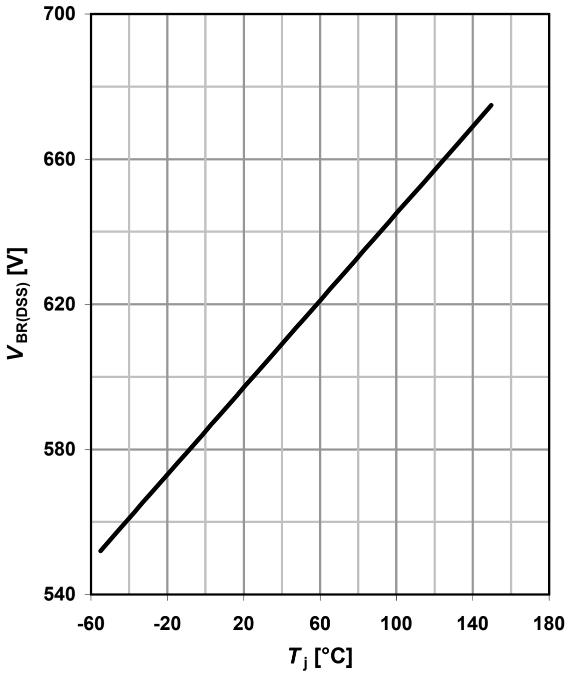
12 Avalanche energy

E_{AS}=f(T_j); I_D=3.1 A; V_{DD}=50 V



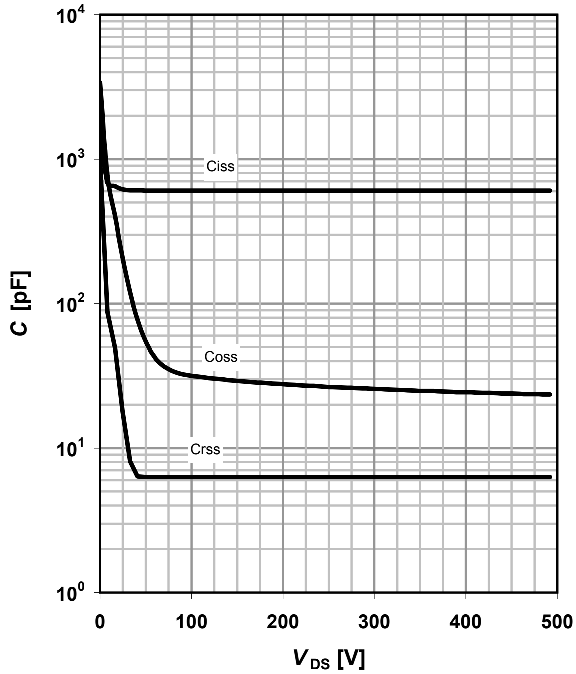
13 Drain-source breakdown voltage

$V_{BR(DSS)}$=f(T_j); I_D=0.25 mA



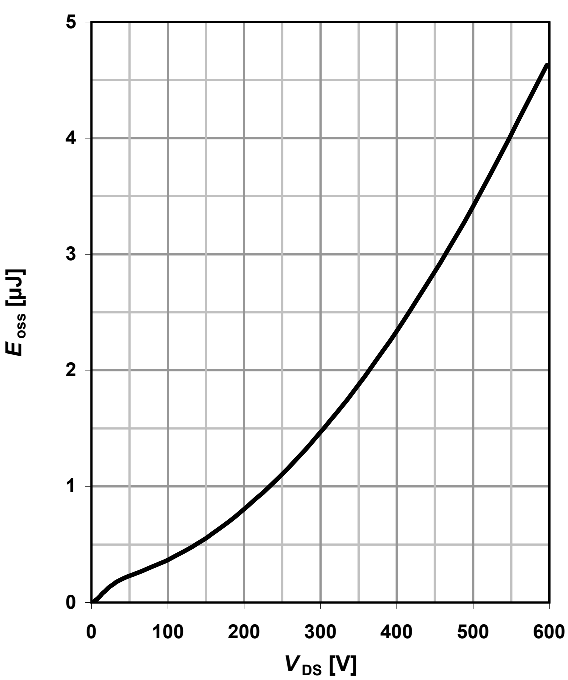
14 Typ. capacitances

C=f(V_{DS}); V_{GS}=0 V; f=1 MHz

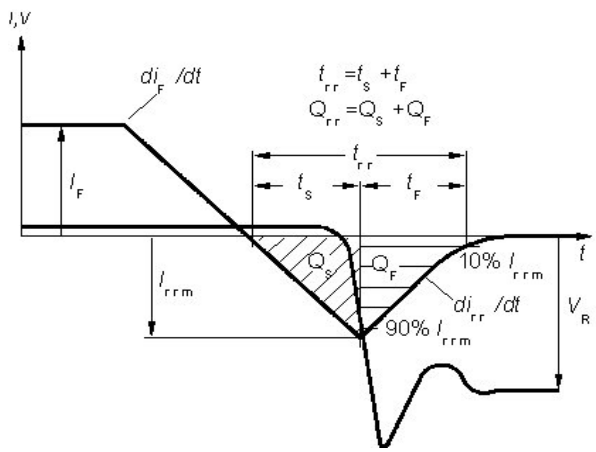


15 Typ. C_{oss} stored energy

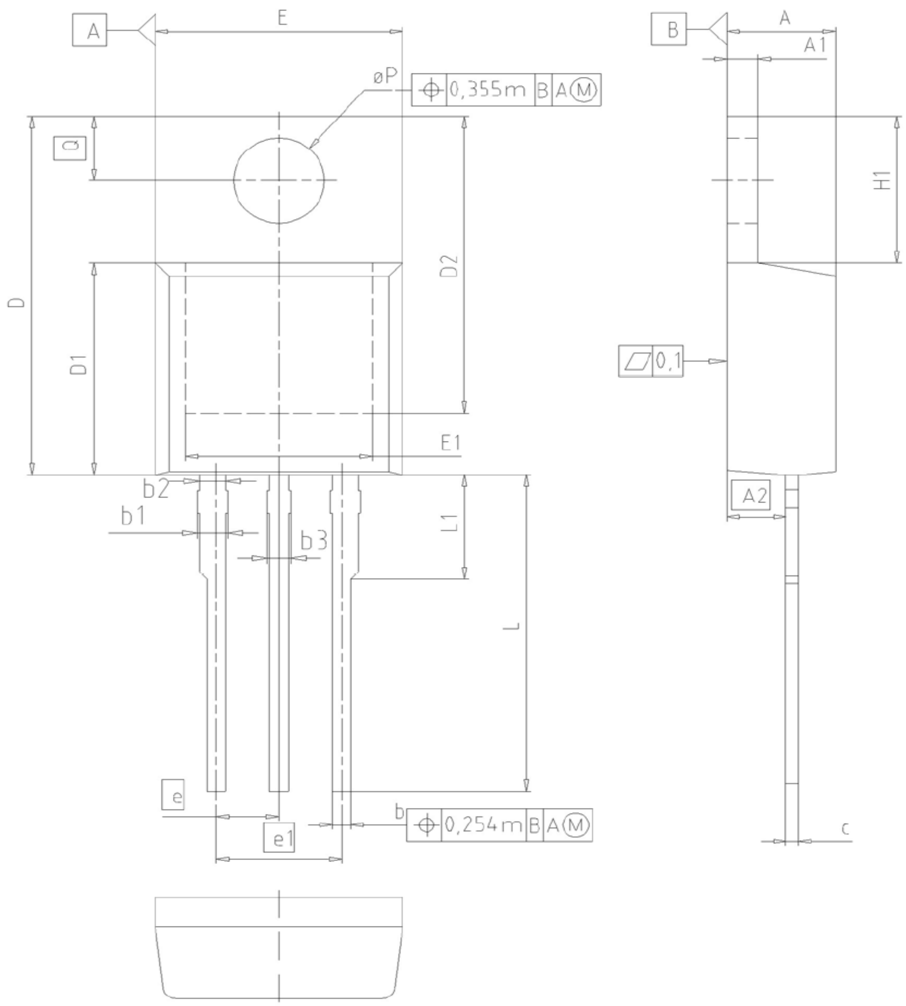
E_{oss}=f(V_{DS})



Definition of diode switching characteristics



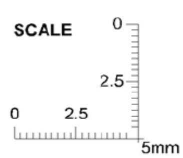
PG-TO220-3-1



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.30	4.57	0.169	0.180
A1	1.17	1.40	0.046	0.055
A2	2.15	2.72	0.085	0.107
b	0.65	0.86	0.026	0.034
b1	0.95	1.40	0.037	0.055
b2	0.95	1.15	0.037	0.045
b3	0.65	1.15	0.026	0.045
c	0.33	0.60	0.013	0.024
D	14.81	15.95	0.583	0.628
D1	8.51	9.45	0.335	0.372
D2	12.19	13.10	0.480	0.516
E	9.70	10.36	0.382	0.408
E1	6.50	8.60	0.256	0.339
e	2.54		0.100	
e1	5.08		0.200	
N	3		3	
H1	5.90	6.90	0.232	0.272
L	13.00	14.00	0.512	0.551
L1	-	4.80	-	0.189
øP	3.60	3.89	0.142	0.153
Q	2.60	3.00	0.102	0.118

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